Cost of illness analysis of Human Immuno-deficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) in a developing economy

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ABSTRACT

Background: Highly Active Antiretroviral Therapy is for lifetime of the patients from time of diagnosis of HIV/AIDS. This translates into a substantial cost in drug therapy to the patients, government and donor agencies.

Objective: To conduct cost of illness analysis of HIV/AIDS in a Developing Economy in 2016.

Methods: A one-year retrospective review of 2560 prescriptions of 396 HIV/AIDS patients' case notes from January to December, 2016 obtained by systematic random sampling from 4800 case-notes of subjects that participated in this study was conducted. Sampling Interval =10
A data collection form was designed and used to collect data generated from the selected case notes. Cost of Illness was determined by prevalence rate method, using direct costs only.

Results: The annual cost of illness for the 396 HIV/AIDS patients on highly active antiretroviral therapy was ₦40,674,760 (US$127,108.3) with drug, diagnostic/monitoring tests, transport, care/support and personnel cost components of ₦25,479,760; US$79,624.3 (62.64%), ₦7,200,000; US$22,500 (17.71%), ₦1,440,000; US$4,500(3.54%), ₦2,880,000; US$9,000 (7.08%) and ₦3,675,000; US$11484 (9.03%) respectively. The annual average cost of illness of HIV/AIDS was ₦102,714.04 (US$320.98)

Conclusion: The annual average cost of illness of HIV/AIDS represent 97% of annual per *capita* income. This is enormous. The Annual National cost of illness for HIV/AIDS in Nigeria, a developing economy may be about N590 billion annually.

Keywords: Cost of Illness, Analysis, HIV/AIDS, Developing economy

Analyse du coût de la maladie du virus de l'immunodéficience Humaine/du Syndrome de l'Immuno-Déficience Acquise (vih/sida) dans une économie en développement

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RESUME

Contexte : La thérapie antirétrovirale hautement active est destinée à la vie des patients à partir du moment du diagnostic du VIH/SIDA. Cela se traduit par un coût important en pharmacothérapie pour les patients, le gouvernement et les organismes donateurs.

Objectif : Mener une analyse du coût de la maladie du VIH/SIDA dans une économie en développement en 2016.

Méthodes : Un examen rétrospectif d'un an de 2 560 ordonnances de 396 cas de VIH/SIDA chez des patients, de janvier à décembre 2016, a été réalisé par échantillonnage aléatoire systématique sur 4 800 cas de sujets ayant participé à cette étude. Intervalle d'échantillonnage =10
Un formulaire de collecte de données a été conçu et utilisé pour recueillir les données générées à partir des dossiers sélectionnés. Le coût de la maladie a été déterminé par la méthode du taux de prévalence, en utilisant uniquement les coûts directs.

Résultats : Le coût annuel de la maladie pour les 396 patients VIH/SIDA sous traitement antirétroviral hautement actif était de ₦40 674 760 ($127 108,3) avec des médicaments, des tests diagnostiques/de surveillance, des frais de transport, de soins/soutien et de personnel de ₦25 479 760 ; $79 624,3 (62,64%), ₦7 200 000 ; $22 500 (17,71%), ₦1 440 000 ; $4 500 (3,54%), ₦2 880 000 ; $9 000 (7,08%) et ₦3 675 000 ; $11 484 (9.03%) respectivement. Le coût annuel moyen de la maladie du VIH/SIDA était de ₦102 714,04 ($320,98)

Conclusion : Le coût annuel moyen de la maladie du VIH/SIDA représente 97% du revenu annuel par habitant. C'est énorme. Le coût annuel national de la maladie pour le VIH/SIDA au Nigeria, une économie en développement, pourrait s'élever à environ 590 milliards de naira par an.

Mots-clés : Analyse du coût de la maladie, VIH/SIDA, économie en développement

INTRODUCTION

Healthcare organizations, governments and individuals have been forced by the prevailing circumstances of economic crisis to be increasingly oriented towards cost containment due to escalating nature of health expenditure.[1] Allocation to health sector is increasing as a result of cost increment, not only because of growing population but also due to new health development. Consequently, total healthcare spending and per capita spending is increasing. Moreover, with the depressing nature of economy in many countries such as Nigeria where per capita income is low[2] there is need for utmost consideration for cost containment measures. Furthermore, the advance in medical technology -"high-tech'', diagnostic and therapeutic options have further complicated the financial picture. Although they offer the potential to improve quality of care, these advances have significantly increased hospitals operating costs (2)

An illness consumes resources, thus, it has a cost.[3] The cost of an illness is the sum of three components: The medical resources used to treat the illness (direct cost) e.g. hospital care, professional services, drugs and supplies, the non-medical resources associated with it (direct cost) e.g. transportation to treatment site and hiring of home care and lost productivity due to illness or disability (indirect cost). A fourth category, the intangible cost of pain and suffering is often unquantifiable.[3]

Human Immuno-Deficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) is a chronic, incurable condition. At the end of 2007, 33 million people were estimated to be living with HIV globally and 2.7 million became newly infected while 2 million died from the disease. About 68% of persons infected resides in Sub-Saharan Africa.[4]

Although, WHO (2009) accorded priority status to HIV/AIDS, many public health planners remain largely unaware of its magnitude and the seriousness of its complications. Of equal consequence, is the increasing prevalence of the disease and the long-term cost of therapy to patients, donors and the health sector, and its cost to nations in economic terms due to the fact that use of antiretroviral drugs in the management of HIV/AIDS is for lifetime of the patients from time of diagnosis. This translates into a substantial cost in drug therapy to the patients, government and donor agencies. HIV/AIDS is of public health importance because it has no known cure. The prevalence is increasing with a wide range of complications that have clinical, social and economic implications.[5] Upon consideration of the impact of antiretroviral therapy on the overall cost of healthcare of HIV/AIDS patients who use this class of drugs for lifetime from time of diagnosis, effort designed to reduce expenditure on this class of drugs as well as use them more effectively would be advantageous. Cost of illness analysis of HIV/AIDS was conducted in University of Ilorin Teaching Hospital, Nigeria, a developing economy
in 2016 with a view of guiding resource allocation decisions to improve effectiveness of drug therapy and efficiency of health service.

METHODOLOGY

Setting

The study was conducted at the University of Ilorin Teaching Hospital (UITH), Ilorin, Kwara State, Nigeria. The Hospital was chosen because it was the only University Teaching Hospital in Kwara state and the major HIV/AIDS referral center in the state.
The bed complements for the hospital were 1,613 as at January, 2016. About 50 registered pharmacists were in the employment of the Hospital. The Hospital runs a medical out-patient department comprising of a general out-patient and specialist medical out-patient clinics. The HAART clinic is one of the specialist medical out-patient clinics and it is run, every Monday to Friday with average monthly turnover of 120 patients.

Study Population and sample size

HIV/AIDS patients that were registered with and attended the HAART clinic of UITH were the subjects for the study. Their population was obtained from Medical Record Department totaling 4,800. Fischer's formula was applied to determine sample size from this estimate.[6] The required minimum sample size was 360. A 10% addition was made to take care of possible attrition.
Inclusion Criteria were HIV/AIDS out-patient registered with UITH HART clinic regardless of sex and concurrent illness, HIV/AIDS patients that have been on drug therapy for at least one year and adult of > or = 18years old. However, HIV/AIDS in-patients and HIV/AIDS patients <18years old were excluded from this study.

Study design

The study was a one year retrospective of 2360 prescriptions of selected 396 HIV/AIDS patients on HAART. Systematic random sampling method was adopted using sampling interval of 10 for case notes from Medical Records department until a total of 396

cases that fits the inclusion criteria were obtained. Excluded case notes were skipped along the sampling process.

Data instrument

A collection form was designed with columns for Code Number as the Patient's Hospital Number, date of visit, demographic data, detailed address, concurrent illness(s), drugs prescribed with duration on each visit and cost, diagnostic/monitoring tests on each visit and cost, transport cost on each visit (to and fro), personnel cost and total cost.

Data collection

The study addressed HIV/AIDS out-patients of the hospital. It involved one year retrospective review of 396 HIV/AIDS patients prescriptions (2560) from their systematic randomly sampled case notes using sampling interval of 10 from January to December, 2016. The following was noted and extracted from the case notes in to the data collection form: Date of Visit, demographic data, concurrent illness, number of visits and prescribed drugs (Anti retroviral drugs and drugs for treatment of opportunistic infections) at each visit as well as duration of therapy. Evidence of diagnostic/monitoring test was also noted and recorded.

Economic perspective

Economic perspective of the donor agency and the hospital were considered since the drugs, diagnostic and transport costs were borne by the donor agency while personnel costs were borne by the Hospital Management.

Cost measure

Only direct costs were considered. These include the cost of drugs, diagnostic/monitoring tests, transportation and personnel.

Drug costs were obtained from donor agency and the cost per defined daily dose (C/DDD) was calculated, taking the duration of therapy into consideration to obtain total cost of drug.

Cost per Defined Daily Dosage (C/DDD) units as recommended by World Health Organization (WHO) for analysis of drug use was applied. DDD represents usual dosage of a drug per day.[7]

Costs of diagnostic/monitoring tests were obtained from the laboratory of the hospital. Time and motion studies were carried out to calculate the personnel costs for Physicians, Counselors, Monitoring and Evaluation Officers, Care/support nurses and Pharmacists. Average time for 15 random observations for completion of tasks such as consultation, counseling, documentation, measurement of blood pressure and dispensing respectively by these groups of personnel was determined and recorded.

The salary of health professionals was obtained from the accounts department of the hospital. The average was considered where necessary.

The mean salary per minute was calculated as follows:

$$\text{Mean Salary/Minute} = \frac{\text{Annual Salary}}{\text{Hours/wk x no. of wks/annum x 60}}$$ [8,9]

In the calculations, the respective number of visits was considered.

Cost of Illness computation

All these costs were added up for each subject, and for all the 396 subjects to obtain the total cost of illness for the 396 subjects. The average cost of illness (cost per subject) was then calculated and recorded.

The average cost calculated is the annual average cost of illness for HIV/AIDS

The Annual Cost of Illness of HIV/AIDS in Nigeria = Annual Average Cost of Illness for HIV/AIDS X (National Projected Rate of HIV/AIDS) 160,000,000 (Total population from 2011 census) X 3.6% (Prevalence HIV/AIDS)

Annual Average cost of Illness for HIV/AIDS = Annual Cost of Illness for the 396 subjects / 396

The exchange rate of 1USD = ₦ 320 obtainable January to December, 2016 was used in this study

RESULTS

Total cost per year of individual drugs for 396 subjects on Highly Active Antiretroviral Therapy

Total cost per year of individual antiretroviral drug and corresponding percentage of total drug cost on the 396 HIV/AIDS patient were: ₦12,864,000 (US$ 40,200), ₦1,584,000 (US$4950), ₦768,000 (US$2400), ₦336,000 (US$1050), ₦2,553,600 (US$7980) for AZT+3TC+NVP, TDF+3TC, EFV, AZT+3TC and LPV/r respectively as indicated in Table 1 below.

Table 1: Total cost per year of individual drugs for 396 subjects on Highly Active Antiretroviral

Therapy Multiple Response N=420

Drug	Total cost per year Naira (USD)	% Total drug Cost	% of Annual cost of illness	No of subjects	% of Subjects involved
AZT+3TC NVP	12,864,000 (40,200)	50.5	31.6	300	83.3
TDF+3TC	1,584,000 (4950)	6.2	3.9	50	13.9
EFV	768,000 (2400)	3.0	1.9	40	11.1
AZT+3TC	336,000 (1050)	1.3	0.8	10	2.8
LPV/r	2,553,600 (7980)	10.0	6.3	20	5.6
Total	18,105,600 (56580)	71.0	44.50		

AZT- Zidovudine. 3TC-Lamivudine. NVP-Nevirapine. TDF-Tenofovir. LPV/r-Lopinavir/Ritonavir. EFV-Efavirenz.

Total cost per year of individual drugs for 396 HIV/AIDS Patients on Drugs used for the treatment of opportunistic infections.

Total cost per year of individual drugs for 396 patients on drugs used for treatment of opportunistic infections in addition to ARV drugs were ₦1,800,000; US$5625 (7.1%; 4.42%) and ₦2,700,000; US$8438 (10.60%; 6.64%) respectively for cotrimoxazole and fluconazole with corresponding percentage of total drug cost and total cost of illness. See table 2 for details.

Table 2: Total cost per year of individual drugs for 396 HIV/AIDS Patients on Drugs used for the treatment of opportunistic infections. Multiple Response N=2500 Subjects

Drug	Total Cost/Year Naira (USD)	% Total Drug Cost	% of Annual Cost of Illness	No of Subjects	% of Subjects involved
Cotrimoxazole	1,800,000 (5625)	7.10	4.42	250	69.4
Folic acid	8400 (26.3)	0.03	0.02	70	19.4
Multivite	108,000 (337.5)	0.42	0.27	200	55.5
Ferrous gluconate	100,800 (315)	0.40	0.25	280	77.7
Loratadine	21,000 (65.6)	0.08	0.05	50	13.9
Paracetamol	54,000 (168.8)	0.21	0.13	300	83.3
Ciprofloxacin	420,000 (1312.5)	1.64	1.03	150	41.6
Amoxicillin	558,000 (1743.8)	2.19	1.37	180	50
Azithromycin	378,000 (1181.3)	1.49	0.93	210	58.6
Tramadol	122,460 (382.7)	0.48	0.32	150	41.6
Arthemeter/ Lumefantrine	496,000 (1550)	1.95	1.22	310	86.1
Fluconazole	2,700,000 (8438)	10.60	6.64	200	55.6
Nystatin oral suspension	607,500 (1898)	2.38	1.49	150	41.6
Total	₦7,374,160 (US$23,044.3)	29.0	18.14		

Annual Cost of Illness for the 396 HIV/AIDS Subjects on Highly Active Antiretroviral Therapy

The annual cost of illness of the 396 HIV/AIDS patients on highly active antiretroviral therapy was ₦40,674,760 (US$127,108.3) with drug, diagnostic/monitoring tests, transport, care/support and personnel components of ₦25,479,760; US$79624.3 (62.64%), ₦7,200,000; US$22,500 (17.71%), ₦1,440,000; US$4500 (3.54%),₦2,880,000; US$9000 (7.08%) and ₦3,675,000; US$11484 (9.03%) respectively as in Table 3 below.

Table 3: Annual Cost of Illness for the 396 HIV/AIDS Subjects on Highly Active Antiretroviral Therapy.

Cost Component	Total annual cost Naira (US$)	% of Annual Cost of Illness
Drug	25,479,760 (79624.3)	62.64
Diagnostic/monitoring test	7,200,000 (22,500)	17.71
Transport	1,440,000 (4,500)	3.54
Care and support materials	2,880,000 (9,000)	7.08
Personnel	3,675,000 (11484)	9.03
Total (Annual Cost of Illness)	₦40,674,760(US$127,108.3)	100.00

Annual average Cost of Illness for HIV/AIDS = ₦102,714.04 (US$ 320.98)

DISCUSSION

The annual average cost of illness (COI) of HIV/AIDS in the current study represent about 97% of annual *per capita* income in the country (Nigeria), using FMOH 2016 report[10] of per capita income of less than 1US$ per day (₦320). This average COI takes into account only the direct costs of therapy. Spending 97% of per capital income on disease management, and only HIV/AIDs is a great burden. In this case, indirect cost (cost due to morbidity, disability, premature mortality and loss of productive output) was not included in the study. This huge resources committed to HIV/AIDS management by donor agencies could be used for other human developmental programmes.

More than half of the patients had oral candidiasis as concurrent illness and were placed on anti-fungal drugs as well, which form 13% of total drug cost and 81.6% of anti-fungal drugs cost. Candidiasis has been reported as the most common oral manifestation of HIV infection and often the initial symptoms, over 90% of patients with AIDS experienced oral candidiasis sometime during the course of their illness.[11] Oral candidiasis is seen with advancing immunodeficiency, generally first occurring when the CD4 cell count falls below 400/mm^3. [12]Candidia albicans, part of the normal oral flora, is the most frequent pathogen but others have also been identified [13]. The fact that fluconazole has been shown to control candida infection might be responsible for its high degree of usage[13]

With an annual average cost of ₦102,714.04, the cost of treating 1000 cases will be ₦102,714,040. Given a prevalence rate of about 3.6% in the country[14] , with a projected population of 160,000,000 from 2011 census [15], about 5,760,000 people or more may be suffering from HIV/AIDS, implying that the annual national cost of illness for HIV/AIDS may be about ₦591,632,640,000 (US$1,848,852,000) i.e. about ₦590 billion annually. This, which is believed to be under estimated because of non inclusion of indirect cost is a lot. Indirect costs are difficult to evaluate, but gray Chang *etal* 2012 has shown that it may be as high as the direct cost.[16] This finding is significant as it will enhance the credibility of our health care system from expected extra year of life for HIV/AIDS patients as an outcome of donor funded HAART in line with the report of Romley and his group in 2009 that people with HIV can get 24 extra years of life from modern treatments at a total cost of about ₦99,024,000 (US$618,900), which is equals to ₦4,126,000(US$12,893.8) Per year.[17]

The outcome of this study is in line with the report of UNAIDS,[12] that to achieve universal access to HIV prevention, treatment, care and support by 2017, requires scaling up of funding to US$ 22-24 billion from US$ 15 billion in low- and middle-income countries to rapidly reduce new HIV infections and to save lives. [18]

WHO in 2009 accorded priority status to HIV/AIDS, many public health planners remain largely unaware of its magnitude and the seriousness of its complications. Of equal consequence, is the increasing prevalence of the disease and the long-term cost of therapy for both patients and the health sector, and its cost to nations in economic terms, due to the fact that use of anti-retroviral drugs in the management of HIV/AIDS is for lifetime of the patients from time of diagnosis.[4] This translates into a substantial cost in drug therapy to the patients, government and donor agencies.

Government need to be proactive by urgently instituting measures such as massive, intensive and sustainable public enlightenment, improved policy on HIV/AIDS prevention, care, support and management. Not only because of the enormous cost associated with its therapy but also because of skyrocketing prevalence rate as reported by UNAIDS in 2017 which will further compound the cost problems and affect productivity.[4,13,18]

The fact that poverty is on the increase is no longer new and is another reason to be more proactive. The percentage of core poor, rising from 6.2% in 1980 to as high as 29.3% in 1997 and reaching 58.2% in 2015 is a cause for concern.[19] In UNDP 2016 report, about 70% (112 million) Nigerians live below the poverty line, earning less than 1US$ (about N320.00) per day [18].

This is worrisome. HIV/AIDS is widely known to be on increase globally and Africa will be the most affected.[13] More so, low income, uneducated and poor people are more affected, [4,13] hence, instituted therapy should be as cost-effective as possible. Effective policy, adequate information education and communication (IEC) strategy must be put in-place to safe guard the health of the nation from ruin by HIV/AIDS among other chronic illnesses.

With increasing prevalence of tuberculosis, malaria and non communicable diseases like hypertension and diabetes and their attendant costs, increased cost of therapy for other chronic condition like HIV/AIDS can further cripple the depressed economy, hence limited resources must be used more efficiently through

economic evaluation of therapeutic options among others.

Measures such as HIV/AIDS counseling, compatible life style, improved adherence to medication and nutritional support/modification need to be taken in order to prevent complications of HIV/AIDS with resultant additional costs. Other modalities include possible home visits by social workers and pharmaceutical care by neighborhood registered pharmacy. These are not without extra costs, and should be weighed against the benefits as well as affordability. It can equally be restricted to selected patients. Enlightenment of patients on grave implications of non-adherence is important. Patients counselling/education and public enlightenment on HIV/AIDS prevention and control measures is of absolute necessity.

Only direct costs were considered which include the cost of drugs, diagnostic/monitoring tests, transportation and personnel. Moreover, the data in the study ware collected in 2016. There might be changes in costs due to changes in socioeconomic factors in a period of time.

CONCLUSION

The Cost of illness for HIV/AIDS in selected 396 patients was ₦40, 674, 760 (US$127,108.3). The annual average cost of illness was ₦102,714.04 (US$320.98), representing about 97% of annual *per capita* income in the country (Nigeria) is enormous. This study has highlighted annual average cost of illness of HIV/AIDS in Nigeria. Developing economy such as Nigeria require continuous support/funding by donor agencies for free HIV/AIDS management as presently obtainable. This effort by the donor agencies should be complimented with preventive promotion initiatives by Government.

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